DOCUMENT RESUME

ED 445 837 RC 021 786

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TITLE Ontario's Old Growth: A Learner's Handbook.
INSTITUTION Ancient Forest Exploration and Research, Toronto (Ontario).; Canadian Nature Federation, Ottawa (Ontario).
SPONS AGENCY Environment Canada, Ottawa (Ontario).
ISBN ISBN-0-920342-15-9
PUB DATE 1996-00-00
NOTE 52p.; For teacher's manual, see RC 021 785. Sponsored by the Environmental Partners Fund of Environment Canada and The Richard Ivey Foundation.
AVAILABLE FROM Canadian Nature Federation, Suite 606, 1 Nicholas Street, Ottawa, ON K1N 7B7, Canada; Tel: 800-267-4088 ($7.00 plus tax & shipping.
PUB TYPE Guides - Classroom - Learner (051)
EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS Botany; Conservation (Environment); *Ecology; Environmental Education; Field Instruction; Foreign Countries; *Habitats; *Observation; Outdoor Education; Plant Identification; *Trees; Wildlife
IDENTIFIERS *Forests; *Ontario

ABSTRACT

This handbook was written in response to an identified need for more public information on Ontario's old growth forests. It is meant to be taken into old growth stands, where the learner can see, touch, and study the natural ingredients of old growth forests. Much of the handbook is a guide to forest history, helping the learner to discover first-hand the signs and artifacts of old growth and the forests of the past. Sources are also provided for finding written historical information about local forests. The guide was written with the forests of Ontario and eastern North America in mind. An introductory section outlines general characteristics of old growth forests, discusses the value of such forests and why they need special attention, and describes the four ecological lives of a tree. The main section, on forest signs and field tips, provides a guide to observation in the woods and covers tree size and life expectancy, canopy gaps and forest regeneration, wildlife and their habitats, dead tree ecology, ecology of tree cavities, cavities as wildlife habitat, classification of log decay and related habitats, mounds and pits (microtopography), fallen tree history, looking at tree rings (dendrochronology), fire scars, and stumps as evidence of forest history. Useful written records include local histories, survey records, and natural resource reports and inventories. (Contains 22 references, illustrations, and an observation checklist.) (SV)

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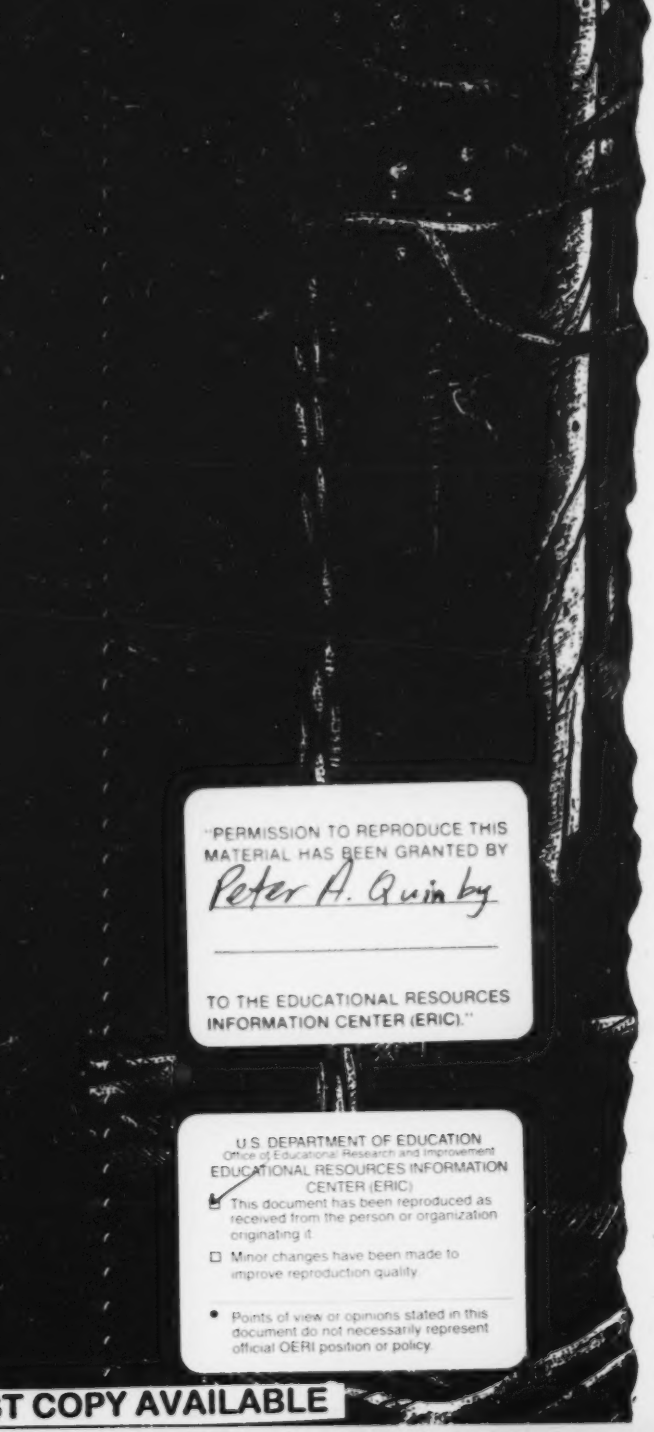

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ONTARIO'S OLD GROWTH

A Learner's Handbook

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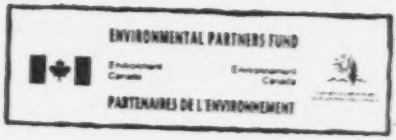

Canadian Cataloguing in Publication Data

Stabb, M. (Mark)
Ontario's old growth: a learner's handbook

Includes bibliographical references.
ISBN 0-920342-15-9

I. Old growth forests—Ontario—Identification.
I. Yearington, Tim, 1965- II. Canadian Nature Federation. III. Title.

SD387.043S83 1996 574.5'2642'09713 C96-900442-7

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Additional copies of this field guide are available from the Canadian Nature Federation, 1 Nicholas Street, Suite 520, Ottawa, Ontario K1N 7B7.

Also available is *Exploring Old Growth Forests — A Teacher's Manual.*

For more information on the Canadian Nature Federation call 1-800-267-4088 or look for us on the World Wide Web at http://www.web.apc.org/~cnf

For Billy, Christoph, Nicole, Sawyer and Sophie.

Text: Mark Stabb
Illustrations: Tim Yearington
Design and production: The HLR Publishing Group
Printing: Tri-Co Printing

Over 55% recycled paper, including 10% post-consumer fiber.

ACKNOWLEDGEMENTS

This handbook was written in response to an identified need for more public information on old growth forests. Both government agencies and non-government conservation organizations have called for increased awareness and understanding of the importance of old growth ecosystems.

In particular, we were inspired by Ontario's Old Growth Policy Advisory Committee who worked long and hard to come up with important recommendations for the conservation and protection of Ontario's old growth — from the northern boreal forests to the rich Carolinian woodlands in the south.

This handbook is the product of many people's efforts. Thank you to Jennene Powers who organized field trips and produced the original field manuals. Thanks also to the Ancient Forest Exploration and Research field team and the students and teachers from Elliot Lake Secondary School and Espanola High School who tested the field techniques. We are also grateful to the educators who participated in the field workshop at the Omagaki Wilderness Centre and to Chris Lemieux who provided valuable comments on content and organization.

The information in this handbook is based on the research of many biologists and forest ecologists who have opened our eyes to the complex and awe-inspiring world of old growth forests. It is largely their work that is interpreted here for a wider public audience.

This project would not have been possible without the support of our sponsors. We would like to sincerely thank the Environmental Partners Fund of Environment Canada and The Richard Ivey Foundation for funding this project and sharing our vision for the conservation of old growth forests. ▲

Caroline Schultz
DIRECTOR OF CONSERVATION PROGRAMS
CANADIAN NATURE FEDERATION

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ABOUT THIS GUIDE

There are many excellent field guides to help you identify what lives in old growth forests. This handbook is different. It helps you understand why the plants, animals and other creatures live there. It is about habitat and forest history — big trees and old trees, trees past their prime, dead and dying trees, stumps and cavities. It is about downed logs and ripped-up root mounds, charred remnants of fierce fires and ancient relics of former forests.

Welcome to the Fascinating World of Old Growth

This handbook invites you to see, touch and study the natural ingredients of old growth forests. The **Forest Signs and Field Tips** section will help you spot old growth features in forests around you. Each feature has value to wildlife, plant growth, and the forest's future. And each helps set old growth apart from younger, managed forests.

Take this guide to search out old growth forests or to examine known and protected old growth stands. Or use it to scour woodlots and other managed forests for signs of old growth. Old growth remnants and old forest features add wildness and habitat to many forests. An **Old Forest Checklist** lets you keep track of your discoveries.

Exploring old growth gives **natural history** a whole new meaning. You get a hint of the ancient forests that people experienced centuries ago when old growth was much more common. You can mingle with veteran trees standing nobly among their younger offspring. You can touch ancestral trees that remain like crumbling ruins from an ancient civilization. Or you can rest on fallen, rotten logs that form the footing for healthy trees.

Much of the handbook is a guide to forest history, helping you discover first-hand the signs and artifacts of old growth and forests of the past. But it also includes a **Paper Trails** section to give you ideas of where you might find written historical information about forests in your area.

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This guide was written with the forests of Ontario and Eastern North America in mind. The topics and tips apply mainly to deciduous and Great Lakes-St. Lawrence forests, but also to other old growth ecosystems like the Acadian forests of the Maritimes. In fact, the handbook is a collection of information from sources across North America. Use the **References and Further Reading** section to find out more.

Old growth and old forest features are natural parts of the landscape. But people have changed the nature of the forest, and now old growth is threatened and quite rare. Gladly, more people are realizing that protecting some old growth is an essential part of forest conservation. Groups and agencies across Canada have identified the need for information and education about old growth forests. And the best way to learn is through first-hand experience.

We hope this field guide inspires you to explore old growth forests and other forests all around you. Consider it a learner's guide to old growth. It will help you look at forests through different eyes, even forests that you already know quite well. When you study the parts of old growth, you learn more about forests as a whole. And you may come to appreciate and celebrate this ultimate stage of a forest — where trees enjoy old age and die natural deaths.

INTRODUCING OLD GROWTH — THE ULTIMATE FOREST

(alias ancient forests, overmature forests, decadent stands, climax forests, primeval forests, virgin forests, pristine forests)

What is an old growth forest? To answer this question, naturalists talk about wildlife and habitat. Foresters refer to big, old trees. Ecologists discuss intricate food webs and soil patterns. Old growth is all these things and more.

Old growth forests are those that are relatively old and relatively undisturbed. "Old" means that the forest's dominant trees are beyond their average life span. "Undisturbed" means the forest is mostly free of logging or other human disturbances.

Old growth is the ultimate forest — it is where nature has taken its course and the forest continues to grow into a fine old age. Old growth was common in the past, when fires, windstorms, disease and other natural forces determined the end of the line for trees and forests. Today logging is more likely to cut short the life of a forest at a younger age and earlier ecological stage.

Very old, unlogged forests differ from younger, managed forests in many ways. Trees grow older, of course, and they usually grow much larger. So do their remains — dead trees are larger, fallen logs are bigger. Old growth qualities reach their peak in forest stands that have had little logging or other disturbance by people.

This handbook is about the ingredients of old growth. It is a guide to the parts, to help you understand the whole forest better. But it does not give one definition for old growth because every forest is different. Each has its own mix of species and its own history. Site conditions like climate, soils, geology and the lay of the land vary from place to place.

Years have been spent trying to come up with formal definitions for old growth. In some ways this debate has distracted us from the heart of the issue — the need to conserve old forests.

Why Do Old Growth Forests Need Special Attention?

Old growth forests have many values to people and to ecosystems. Old growth stands are:

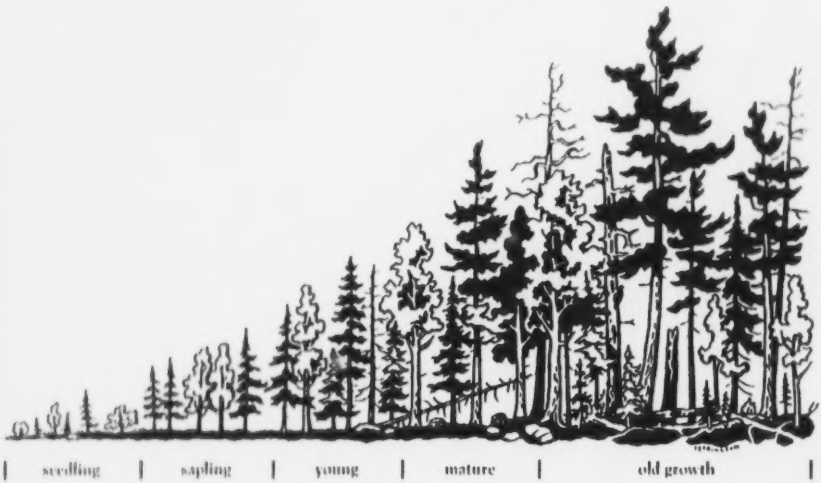
- benchmark sites for scientific research
- sources of natural diversity on the land
- natural sources of forest history information
- habitats for old forest species and wildlife communities
- sites of natural ecological processes
- living manuals for how natural forests work

This handbook focusses on ecology, but old growth forests also have important social, cultural and economic benefits to people.

Conservation today includes protecting all the biological diversity created by forests. Old forests and young forests each are important in their own way.

Forests that are young or mature are relatively common. Very old forests, on the other hand, are rare. No matter what type of forest, no matter where you are, older forests and their habitats are threatened.

Old growth forest remnants are also at risk. Elements of old growth that exist in younger forests provide important ecological services and enrich the habitats for wildlife. You may find some ingredients of old growth in almost every forest you explore. But, these remnants often do not survive standard logging activities.



Stages of forest growth. Most forests are cut before they reach their natural old growth state.

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The Four Lives of a Tree

Trees have an afterlife. In fact, you could say that trees have four lives — the young tree, the mature tree, the dead standing tree, and the fallen tree.

The first life as a sapling and young tree is a struggle to survive and reach maturity. A tree that survives this stage enters its second life as a mature tree. There it finds a place in the forest canopy and may reach its maximum size. But death is inevitable, and so is the tree's afterlife.

When a tree is logged, it may return as furniture, paper or other wood products. But when a tree dies a natural death in the forest, its body and influence live on, first as a dead standing tree and then as a fallen log.

Fire, lightning, insect attack, disease, flooding — death takes its toll on living trees of all ages. These dead trees are not dead ends because they launch a new stage of forest life. Dead standing trees (also called snags) are important for many wildlife species, from eagles and woodpeckers to bats and tiny insects.

Wind, storms or gravity eventually topple trees and their ecological life continues. Logs and dead branches (also called down woody debris) can last over a hundred years on the ground. This debris is raw material for ecological processes such as nutrient cycling and plant regeneration and is also habitat for wildlife.

Old growth forests are places where you can find all four ecological lives of a tree, with each life meaning something different to the forest ecosystem. Dead trees and fallen logs can easily last as long in the forest as when the green tree was "alive," sometimes longer. A forest without dead trees and downed logs is in many ways like a house without any furniture. It is not complete without them.

Old Growth Forest

- Large and/or old trees
- Trees with few branches to canopy
- Canopy has many layers
- Large canopy gaps
- More uprooted trees
- More large dead or broken trees
- Logs and woody debris common
- Streams crossed by large logs and debris
- Few signs of logging
- Natural tree species diversity
- Ground hummocky from mounds and pits of fallen logs and root tip-ups
- Undisturbed soil and woody debris means greater water retention and soil retention

Younger Forest

- Smaller and younger trees
- Trees branches along trunk
- Canopy has fewer layers
- Smaller canopy gaps
- Fewer uprooted trees
- Fewer large dead or broken trees
- Logs and woody debris uncommon
- Streams have less large woody debris
- Logged regularly, old logging signs
- Species diversity affected by logging
- Less evidence of tip-up mounds
- More disturbance and less woody debris means less water and soil retention

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Old growth forests are diverse habitats – from old trees and fallen logs to tumbling creeks.

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FOREST SIGNS AND FIELD TIPS

Much of this handbook is designed to be used in a forest. Keep it with you on your regular travels through the woods or select a forest to examine for old growth features. Keep your eyes peeled for some or all of the old growth ingredients described on the following pages. You can use the **Old Forest Checklist** to keep track of your findings. The more signs you see, the closer your forest is to old growth.

Old Trees, Big Trees

When you think of old growth in eastern Canada you might picture towering pines, massive yellow birches, maples and beech trees, or dark hemlock stands. Big, old trees are a good sign of old growth. Looking at them is the first step to understanding old growth ecology.

Tall, cathedral-like groves of trees strike awe into people. Big, old trees make great photos and they also make old growth. They create it by dying, by getting burnt to a crisp, or lightly toasted by fire. They build it when their tops get blown off, when they get poked full of holes by woodpeckers and when they collapse or get their roots yanked out during storms. And they help produce old growth by rotting to a juicy pulp on the forest floor.

Many of the old growth traits in this handbook are products of big, old trees. "Big" means beyond the typical size cut for timber, although bigger is not always better. If you can estimate heights and diameters of your trees, try comparing them to typical heights of trees that you can read about in tree field guides.

You may want to compare trees in your area to Ontario's all-star list: the Honour Roll of Trees. The Ontario Forestry Association prints a guide to the biggest specimens of each tree species in Ontario. The list is updated each year, and looks at the height, diameter and crown size of each tree. Copies of the Honour Roll can be obtained from the Ontario Forestry Association, 150 Consumers Road, Willowdale, Ontario M2J 1P9.

When you find very big trees in a forest you have discovered new habitat conditions for plants, wildlife and regeneration. When you find a forest full of very old trees you are looking at an interesting and healthy ecosystem.

Old trees themselves, through their ages, growth rates, scars and wounds, are valuable recorders of history of the site. They are also a wealth of genetic diversity that is essential for future forest health.

The biggest trees are not always the oldest. A forest's productivity has a great influence on the size and age of

trees. For example, a moist well-drained slope grows bigger trees faster than a dry hilltop with shallow soils. Even within a group of similar-sized trees, ages can vary a lot. In one old growth stand in Algonquin Park, for example, white pine trees aged at around 450 years old ranged in size from 53 centimetres to 117 centimetres in diameter (at breast height).

In contrast, the scraggly, twisted cedars along the Niagara Escarpment, which might be only a dozen centimetres in diameter can be more than 1,000 years old. The gnarly white cedars cling to cliff faces, where they have survived fires and cutting long enough to be discovered by scientists in the 1980s.

If trees are given the chance they can reach a ripe old age (see opposite table). Except for birch and poplar, trees are often cut before they have completed half of their potential life span. If you can determine the average age of the trees you are examining, or the age of the oldest trees in your stand, try comparing them to the life expectancy table. This will give you an idea of how your stand measures up to the potential age of that tree species.

Counting tree rings is one way of studying tree ages. Trees lay down layers of wood in a yearly pattern that can be counted on cut trees, tree stumps and tree cores. The summertime spurt of light-coloured growth is followed by a darker layer indicating slower growth the rest of the year.

Common Life Expectancy of Trees in Old Growth Stands

Eastern hemlock	600+ years
White pine	450+
Eastern white cedar	400+
Red pine	350+
Sugar maple	300+
Yellow birch	300+
White spruce	200+
Red oak	200+
Black spruce	200+
Poplar	150+
Jack pine	140+
White birch	80+

Source: Ontario Old Growth Policy Advisory Committee Final Report

If trees have been cut recently, you can count rings on available logs or stumps to get an idea of the age of the stand. If you have access to a tree corer (also know as an increment borer) you can get age estimates from live trees. Or you can get information from Forest Resource Inventory maps for the area. These are available for viewing at Ontario Ministry of Natural Resources offices.

When examining a forest you may experience a number of familiar scenarios. In old woodlots, sugar bushes, or some managed forests, big old trees may be all that remain of old growth conditions. Dying and diseased trees get removed in favour of healthy vigourous ones. Dead trees get cut for

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firewood or safety concerns. Large dead trees and logs become uncommon. Many landowners have the tradition of "cleaning up" woodlots by removing the dead wood.

In other cases, forests have been "high-graded." The biggest and best trees were harvested for timber, and no forestry work has been done since to revitalize the stand. Look for a stand with many old, trees of poor (timber) quality, full of broken or diseased parts and an interesting array of crooks, twists and bends in the trunk. Rot, cavities and big "holey" trees will be abundant. Foresters often target these stands for "improvement" — meaning defective trees are removed to make room for prime trees for timber.

Gaps and Regeneration

Hardwood forests are less susceptible to fire than, for example, forests of pine and poplar. When hardwood stands reach an old age, they can regenerate themselves through numerous small scale events. Large trees in old growth and mature stands create their own disturbance when they fall to the ground or get blown over. Young trees and other plants thrive in the light-filled gaps that result. Previously-suppressed trees get a chance to grow and reach the canopy right next to much older trees.

As canopy gaps become filled by younger trees, a stand of trees of all ages is created — a feature of many old growth forests. A multi-layered canopy can also result. Different heights of trees that create different habitats for wildlife.

Stands that grow up following fires or other major disturbances, such as land clearing, tend to have many trees of roughly the same age. Amid the new growth you might find a few "grand-daddy trees" that survived the earlier disturbance. Mature versions of these "even-aged stands" are on the verge of becoming old growth. Some pine stands may have trees of all ages, due to windthrow events or periodic light burning which kills only a few trees at a time. Up to 10 percent of the white pine forests may regenerate this way before another fire occurs.

Old Forest Wildlife and Habitat

Old growth forests are distinct habitats for wildlife. They have a diverse structure and thus many niches for wild creatures. Several species prefer old forests, and likely fare best in the ecological conditions that old growth provides.

Food supplies vary as forests age. Arboreal lichens, for example, slowly grow on trees over decades and are most abundant in mature and old growth forests. Tree seeds, including conifer and hardwood seeds, support small mammal communities and therefore their predators. Seed production increases as trees age and likely peaks just before a tree starts to decline.

Woody browse from shrubs, seedlings and saplings are abundant in

young forests, but decline as the forest matures. Although not an abundant food source in old growth, browse makes a comeback in gaps created by fallen trees.

Pileated Woodpeckers and American marten are considered indicators of old forest conditions in many eastern forests. In boreal forests woodland caribou also depend on old forests, relying heavily on the arboreal lichen communities when thick snow covers the ground in winter.

The Pileated Woodpecker, Canada's largest, relies on large diameter trees for nesting, large hollow trees for roosting, and large dead trees or downed logs to feed on. The Pileated seems to be on the increase following a decline a century ago when virgin forests were first cut. The birds may be adapting to younger forests and smaller woodlot habitats. Still, old forests are prime habitats, and when you see a Pileated Woodpecker you know their are old forest features around.

Pileated Woodpecker feeding on a dead pine with super-canopy trees on the horizon.

American martens are much more elusive creatures. If they live in the area you are lucky just to see their tracks. Trapping records, mammal books or field guides will help you determine the distribution. These tree-climbing weasels are very uncommon in younger forests and seem to prefer large unbroken tracts of old forest with big coniferous trees.

Martens use large tree cavities or logs for denning and search these same trees while hunting. Cavity-dwelling flying squirrels are important food items. Large diameter logs that criss-cross old forests provide runways for marten. In winter, logs provide spaces that allow the marten to move around beneath deep snow. These "subnivean" (under the snow) passages are also readily used by small mammals. The fisher, a larger relative and competitor of the marten, does not use habitat in the same way.

Wildlife of old growth includes less conspicuous but still important organisms such as mosses, liverworts, lichens, fungi, insects and other invertebrates. If you look under old logs or rocks on the forest floor, you may find chunky black insects called ground-beetles. Researchers are studying this group of beetles as indicators of the condition of a forest. Some species turn up only in old growth. They are just one tiny example of the unmeasured diversity of insects and micro-organisms of old growth.

Forests have long histories and within forests some trees have longer histories than others. A view from a lake, ridge or cliff may show you trees poking up above the rest of its neighbours. **Supercanopy trees,** as they are called, are often used as nest sites for birds such as eagles and as sanctuary trees for black bears. Female black bears will send their young up these trees for refuge and will often bed down at the base of these trees. White pine is a typical supercanopy tree in forests that are predominantly deciduous. Large-toothed aspen and tulip-tree to the south are other examples.

When scanning the treetops, look for big **stick nests**. The Red-shouldered and Cooper's Hawks are two rare species that build large nests in very mature forests. Other large nest builders are Northern Goshawks, Red-tailed Hawks, Broad-winged Hawks and Sharp-shinned Hawks. If you come across an active nest, let the landowner know to encourage conservation of the nest site. If you find the nest on Crown land, inform the local office of the Ministry of Natural Resources. Similar nests may be used by ravens, crows, Great Horned Owls and other large birds.

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Don't be confused by squirrel nests or "bear nests." Squirrel nests tend to be out in the branches and look like big balls of leaves. Bear "nests" are regularly seen in beech or oak trees. Bears feeding on acorns, beech nuts or other hefty seeds will climb to the treetops and pull in food-laden branches to their resting spot. Many branches break in this process and the resulting pile of sticks may resemble a nest.

The size and variety of dead trees, logs and other structures created by unlogged trees are special assets of old growth. Wildlife live in, around, on and under these features, and help make old growth habitats unique.

Martens live in large tracts of mature and old growth conifer forest.

Dead Standing Trees

(alias snag, stub, chicot [pronounced cheeko], dead tree, cull tree, senescent tree, defective tree, rotten tree, cavity tree, den tree, hollow tree, roost tree, wildlife tree)

Dead Tree Ecology

Trees growing in old growth forests stretch the limits of their life support systems. Much like people, trees rarely die strictly of old age. In a tree's twilight years it is complications that push them over the edge. Old trees cannot fight disease or withstand attacks by insects or fungi as well as they once could. They are less efficient at gathering water and soil nutrients and at competing for light. Growth slows down, branches and roots wither and the trees struggle to fight gravity to keep a spot in the forest canopy.

The environment may also do them in. Winds, snows, floods or fire may cut short a tree's life at any time. Fire was once a major creator of new forests and hoardes of dead trees. The charred remains of former forests live on in many forests today. But output from fire's dead tree factory has been mostly shut down by fire suppression.

Lightning strikes are still the cause of many natural fires that will kill individual trees. Tall trees poking above the forest canopy or perched on hilltops are especially vulnerable to lightning strikes. Look for spiral seams on tree trunks, evidence of earlier lightning strikes. The spiral is caused by the lightning following a twist in the wood.

Beaver feeding and flooding creates pockets of dead trees of all shapes and sizes across the landscape. The dry skeletons of trees in beaver ponds stay standing for some time because the root systems are less prone to decay while underwater.

Black bears feeding on nuts or acorns and porcupines browsing on twigs and bark can kill parts of trees and aid in their decline. Yellow-bellied Sapsuckers can also cause some damage to trees, but contrary to common belief, woodpeckers are not a significant cause of death. When you see evidence of feeding and nesting, the trees are already dead, dying or in decline.

Young forests are chock full of small dead trees. Many young trees are naturally "thinned out" of young stands as they lose the race for light or nutrients with neighbouring trees. The result is many small diameter dead trees that soon fall to become small logs on the ground. After this natural carnage, middle-aged and nearly mature forests tend to produce fewer dead trees for a number of years.

Old forests increase dead tree production once again as large forest giants die while standing or crash to the ground, damaging surrounding trees. Old growth forests have a greater abundance and variety of large dead trees (snags) than younger or mature forests.

Deciduous trees that die while standing often become rotten and hollow on the inside. The hard outer wood keeps the shell of the tree intact while the inside is available for nesting. Coniferous trees often decay from the outside in and are more likely to fall to pieces. Hard

snags last a good long time. Soft snags, such as punky poplars and birches, are common but crumble more quickly. Both types of snags are valuable to the forest. A diversity of dead trees means stability for parts of the wildlife community.

Not all causes of death are worth celebrating as natural events. Pollution and introduced insects such as gypsy moth cause the decline and death of many trees as well.

Dead Standing Trees and Wildlife

Dead trees naturally provide habitat for about 25 percent of all forest wildlife species. Great Blue Herons, Bald Eagles and Osprey nest at the tops of snags or in the dead tops of living trees such as white pine. All prefer trees near or above water. Dead branches are prime perching sites for birds. Flycatchers, kingfishers, hawks, eagles and other birds hunt from these sites.

As dead trees decay the protective bark begins to slough off. Several bat species as well as insects such as some butterflies roost under loose bark as do some birds. Brown Creepers seek these crevices, wedging plant material into the space to nest.

Fungi, moss, lichens and bacteria begin the process of decay even before a tree completely dies. Their mechanical and chemical activity breaks down the woody material, paving the way for entry and feeding by insects. Termites, carpenter ants and other insects chew into the wood to form galleries and build nests. These insects then attract woodpeckers and other excavating birds and mammals. For more detail see the **Tree Cavities** section.

Woodpeckers are not considered songbirds, and if you have heard their calls you know why. They squawk, squeak and give harsh staccato cries. They also communicate by drumming. When you hear or see a woodpecker drilling like a jackhammer on the wood, the odds are the bird is making a territorial statement rather than a feeding noise. Woodpeckers making sporadic, irregular and softer whacking sounds are more likely digging for food.

Woodpeckers tend to drill or drum on dry, dead wood because it gives the best resonating sound. You can hear the difference yourself by knocking fresh branches together and comparing that to the sound produced by two dried branches. If you do this in the woods you might get a visit from a curious woodpecker.

BE CAREFUL AROUND DEAD TREES!

Dead trees may be very unstable and can fall down with only a gentle nudge. At ground level some snags may look like live trees if they still have their bark. A quick look at the foliage should tell you whether or not it is still alive. Workers in the forest industry are very aware of this danger and are required by legislation to cut down any trees that pose a threat where logging operations are occurring.

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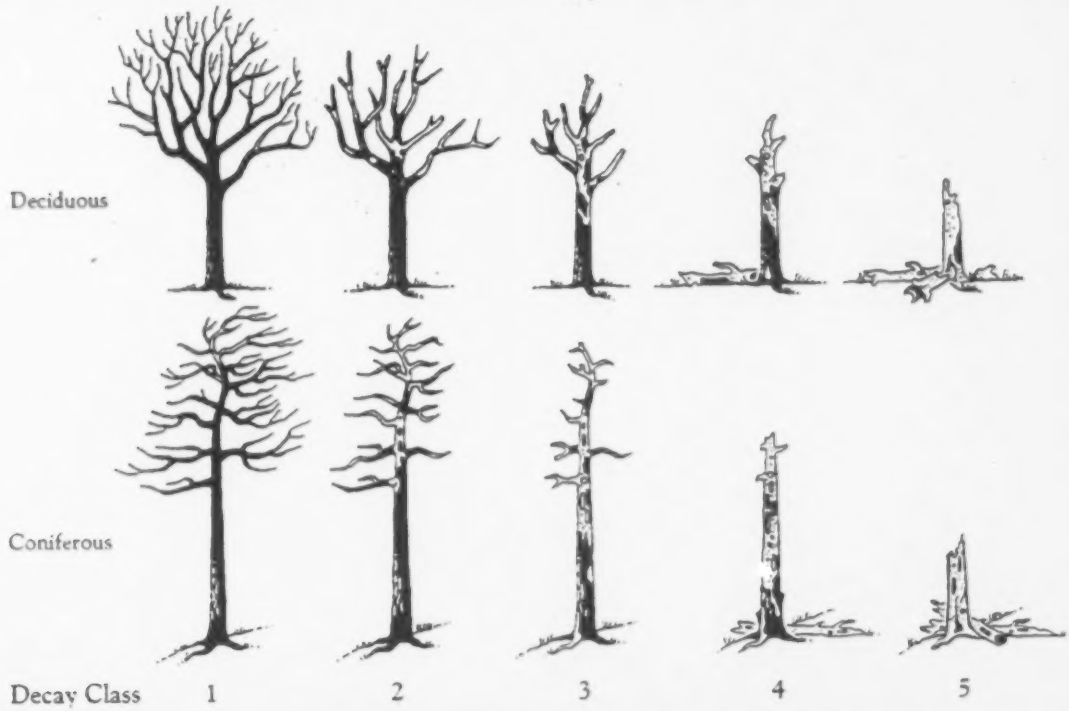
A Guide to Dead Trees

Dead trees are vital parts of wildlife habitat, providing food and nest sites as they decay and crumble to the ground. The stages below have been used to study dead trees in forests in different parts of North America.



FIELD SIGN	LIVE TREE with dead and dying branches or broken top	DECAY CLASS 1	DECAY CLASS 2	DECAY CLASS 3	DECAY CLASS 4	DECAY CLASS 5
TREE TOP	• Broken top or dead stub on tree top	• Tree top intact and just recently dead	• Tree top intact	• Tree top intact	• Top broken off	• Top broken to a stub, less than 6 m high
BRANCHES	• Many or most branches still alive • About 25% of canopy dead	• Recently dead • Fine branches still present.	• Fine branches gone Less than half of large branches gone	• More than half of large branches gone	• All large branches gone	• All large branches gone
BARK	• Bark on trunk intact • Bark on branches may be dead	• Bark mostly intact	• Bark loosening	• Bark usually falling off	• Bark nearly gone	• Bark and wood deteriorating
CAVITY NESTERS	• Dead sections may be used by cavity nesters as per decay class • Yellow-bellied Sapsucker may already be nesting in tree • Dead parts of tree used as drumming and display sites for woodpeckers • Pileated Woodpecker can excavate these living trees	• Same as live tree with dead top • Pileated Woodpecker — strong excavator — can use this tree	• Used for nesting and foraging sites for strong excavators like Pileated Woodpecker	• Nesting site for weaker excavators like Downy and Hairy Woodpecker	• Used by weaker excavators like the Downy Woodpecker for nesting sites and then by cavity nesters like flying squirrels	• Used by weak excavators like chickadees as well as mice and chipmunks for nesting sites
OTHER WILDLIFE USE	• Waterfront nesting sites for Osprey, eagles and herons. Tree top perching and hunting sites for sites for hawks, owls and perching birds. • Dead branches are common perching sites for birds such as Eastern Phoebe, Acadian Flycatcher and hummingbirds. • Used by herons, raptors and perching birds. Brown Creepers nest and bats roost under loose bark.					

This system helps you see the differences in the dead trees around you and learn about their value to wildlife and the forest.
Trees do not always fit neatly into categories such as the ones here. Tree tops, for example, often snap off creating a fresh, hard snag with little decay evident.

Tree Cavities

(alias tree holes, woodpecker holes, dens, hollows, roost holes, nest holes)

Cavity Ecology

Rotten, crumbling or dry as a bone, decrepit trees make a solid contribution to wildlife habitat — especially if someone pokes a hole in them. Tree cavities in both dead and live trees are prime homes and hideouts for about 15 percent of Ontario's wildlife — some are included in the table on page 29. Every forest has animals that rely on tree cavities. The large number and variety of tree cavities are important elements of old growth forests.

A perfectly healthy tree is a rare sight. Wounds, insect damage, rot or disease help shape trees from an early age. Before long, tree cavities form in dead or damaged trees.

- Weathering, fungus or microorganisms can rot away wood, creating irregular natural cavities.
- Woodpeckers or other wildlife can excavate holes in decaying trees for food and nest sites.

Cavities made without the help of woodpeckers may be more abundant in the forest than actual woodpecker holes. But the solid holes and protected chambers made by woodpeckers often provide better conditions for nesting and den sites for wildlife.

Look for dead or broken branches, snapped tops or large open holes in live trees. Each indicates that parts of the trunk are rotten. If you see a tree with all three of these signs, half of its trunk could be decayed. Dead parts of live trees allow decay organisms to enter. This can create cavities without the help of woodpeckers. Wherever you find a natural cavity in a tree, the trunk could be rotten for a metre or more up or down the stem.

Cavities often form in knot holes and broken branch stubs.

Certain fungi are signs of rot and potential cavities in live trees. The well-know Artist's conk and Tinder fungus are involved with rotting the outside wood (the sapwood). False Tinder fungus, on the other hand, is involved with rotting the inner wood (the heartwood) and is a good indicator of suitable conditions for cavities inside a tree.

Woodpeckers excavate round and oval nest holes in both live and dead trees.

A dozen species of wildlife in eastern Canada dig holes in trees for nest sites. Most are woodpeckers, but two species of chickadees and one nuthatch species also excavate cavities for nesting. It is helpful to get to know these species, because their work creates homes for a variety of other wildlife. Watch for the species and the holes presented on the following pages.

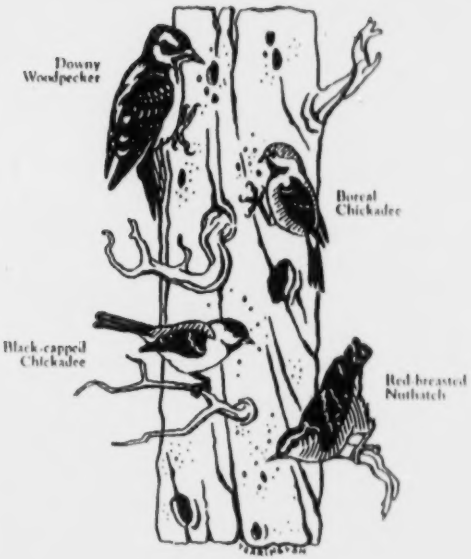
Woodpeckers drill through the bark and outside wood of a tree to get to softer, rotten heartwood at the core. It is possible that they detect this decay by listening as they peck at the trunk. The birds do make false starts, but many of the round, deep, dark holes you see end in a nest chamber. Roughly-edged, irregular-shaped holes are more likely to be feeding sites. Smaller cavity-makers such as chickadees make homes in soft, punky trees.

Cavities and Wildlife

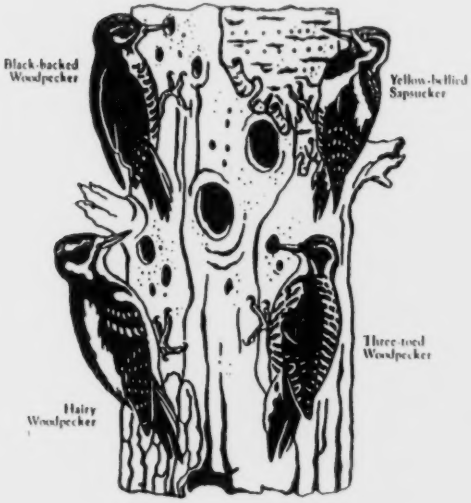
There are advantages to living in a hole. A tree cavity gives shelter from wind, rain or snow and is a stable environment in which to incubate eggs or raise young. Thick cavity walls also give protection from many predators. An astounding diversity of wildlife make cavities their home.

Ducks, flycatchers, warblers, wrens, thrushes, falcons, owls, mice, squirrels and even some weasels use natural cavities and abandoned woodpecker holes for nesting, resting, storing food or raising young. Honeybees and bumblebees also use cavities. As the years go by, a succession of wildlife species may used a single cavity.

All cavity trees are not created equal. Live trees with holes, for example, last longer in the forest than dead ones. As well, the larger the tree, the greater the variety of species that could make it a home. Pileated Woodpeckers, which regularly nest in trees with a diameter of 50 centimetres or more, would not use a fencepost-sized stub. But the small stub could be inhabited by a chickadee. Sapsuckers often nest in live trees with rotten cores while



Birds that create cavities with small entrance holes.



Birds that create cavities with medium to large entrance holes.

Downy Woodpeckers tend to use dead trees.

Surrounding habitat is also important. A Pileated Woodpecker hole in a dead tree near the edge of a swamp may be used by a Wood Duck. A similar tree deeper in the forest may be used by a Saw-whet Owl. Place the same tree in a forest opening or clearing and it may attract an American Kestrel or Northern Flicker. If the hole were smaller, say the size made by a Hairy Woodpecker, the waterfront tenants could be Tree Swallows. The forest tenants could be northern or southern flying squirrels and in an opening or clearcut the hole could be home to bluebirds.

All cavity trees are valuable but those with multiple cavities of various sizes provide more habitat opportunities. Larger trees with large holes are less common and thus are in short supply — when you see them you are looking at a valuable piece of real estate for wildlife.

Many scientists, biologists, foresters and conservation agencies have worked on the question: "How many snags are needed for cavity-dwelling wildlife?" The larger trees, such as those 50 centimetres or more in diameter, are of greatest concern. A consistent number across the continent appears to be 5 to 10 large diameter cavity trees per hectare. A hectare is roughly the size of two football fields. If your forest has that many large cavity trees, as well as a larger number of smaller trees for feeding and nesting, the needs of cavity-nesting wildlife will be met.

Old growth forests produce many cavity trees naturally. Managed forests can also produce large cavity trees when logging is planned carefully and with attention to habitat concerns.

Tree cavities are not used just as nest or den sites. Woodpeckers often excavate separate **roosting holes** in which to spend winter nights. Screech owls and other cavity dwellers also use holes for winter shelter. Flying squirrels may use holes as food caches, retreats from predators or inclement weather and even as private outhouses.

Hollow trees and large holes are prime roosting sites and escape cavities for wildlife.

Wildlife species use **escape cavities** as temporary shelters or to avoid predators and bad weather. Look for holes that are too large to protect nests with young, or which have rotten, irregular edges.

"**Church doors**," large openings at the bases of trees, are readily visible escape cavities and potential den sites for porcupines and raccoons. Fungi often cause the "butt rot" at the base of these trees. You might try looking for one of the culprits — the shoestring fungus (Armillaria). It has a black network of shoelace-like segments that is often visible on dead wood and beneath peeling bark.

Woodpecker feeding cavities tend to be shallow and irregular in shape.

Woodpeckers hammer away at trees in search of beetles, carpenter ants, insect larvae and other organisms. This feeding leaves dead end holes, trenches or pockets in a trunk or branch. **Feeding cavities** are usually not round and lack the typical chambers that could hold a nest. Pileated Woodpeckers create deep rectangular feeding cavities and may riddle the tree with such holes. Forest workers have dubbed some of these trees "woodpecker pines." Other woodpeckers make irregular holes or patches by digging up and down the tree.

Even if a cavity gets filled with water it is of value. Some insects breed there and some animals, such as flying squirrels, that use the cavities as watering holes.

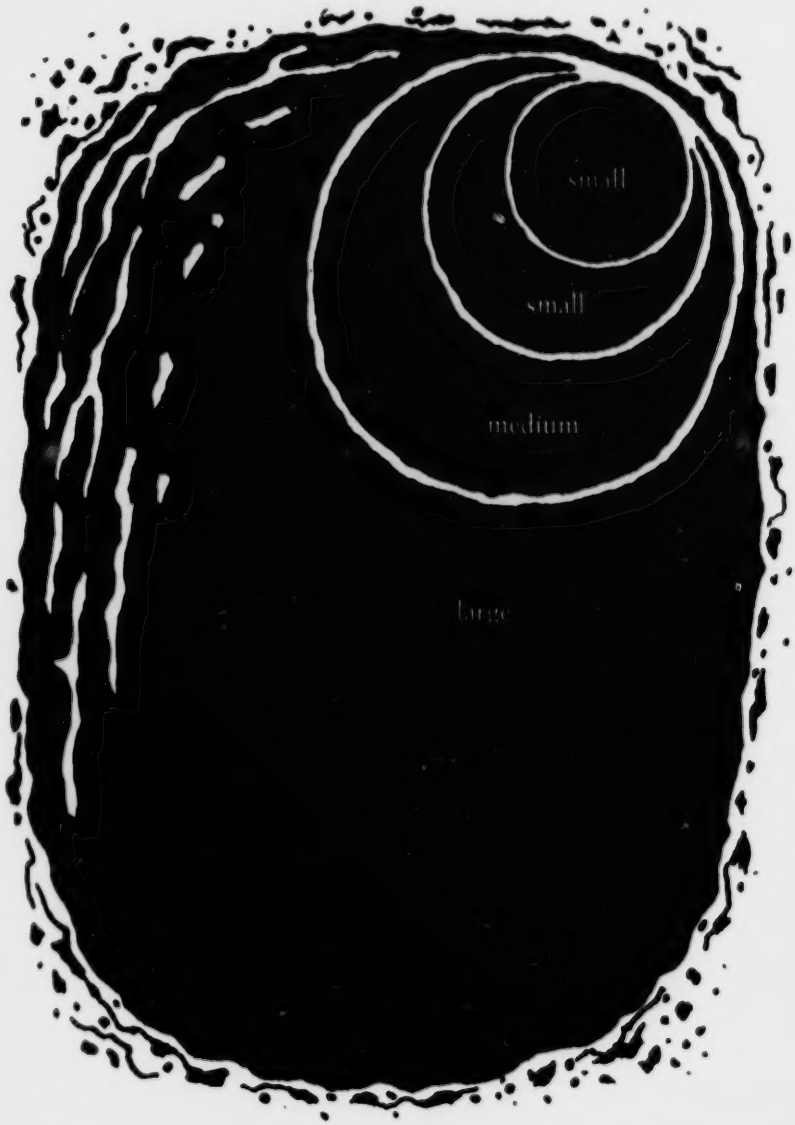
The Yellow-bellied Sapsucker is unique, creating lines and lines of holes in live trees to seek sap (and the insects the sap attracts). Their feeding, however, may kill parts of trees which are then used by other cavity-nesters.

Use the following guide to trace who made the holes you see, and the other species that you might find using them.

30

A Guide to Nest and Den Cavities

Entrances to nest or den cavities are usually surrounded by sound wood and are large enough to allow access by the animal but exclude its predators. The holes can be excavated or natural, large or small. Binoculars may be used to observe cavities that are located high above the ground. Evidence of use includes a smooth, worn or lightly coloured entrance — resulting from repeated brushing by the animal — gnawing, fur or feathers, no spider webs, and nesting material protruding from entrance.



This guide is a rough breakdown of some of the birds and mammals that make and use tree cavities in forests in eastern Canada. Don't be too surprised if you find wildlife in cavities that do not conform to this summary. Nature is full of variety.

Note that larger holes are potential homes for more wildlife species than smaller holes. In general, animals tend to use holes similar to their body size, possibly a result of competition for cavities as nest or den sites.

CAVITY SIZE	CAVITY DETAILS AND DWELLERS
Small	• 2.5 – 5.5 cm diameter hole • size of a two-dollar coin to the size of a raquetball excavated by Downy Woodpecker, Yellow-bellied Sapsucker, Hairy Woodpecker, Black-capped Chickadee, Boreal Chickadee and Red-breasted Nuthatch • small holes can be used by Tree Swallow, White-breasted Nuthatch, House Wren, Carolina Wren, Eastern Bluebird, European Starling and Prothonotary Warbler • small dens for deer mouse, eastern chipmunk, red squirrel, northern flying squirrel and southern flying squirrel
Medium	• 5.5 – 10 cm diameter hole • size of a hardball to the size of a grapefruit • excavated by Northern Flicker, Red-headed Woodpecker, Red-bellied Woodpecker, Black-backed Woodpecker and Three-toed Woodpecker • medium-sized holes can be used by all small hole-nesters (above), plus Wood Duck, Screech Owl, Boreal Owl, Saw-whet Owl, American Kestrel • dens for all mammals above, plus grey squirrel
Large	• 10 – 12.5 cm wide and 12 – 20 cm high • size of paperback novel with rounded edges • excavated by Pileated Woodpecker • large holes can be used by all hole-nesters above, plus Common Goldeneye, Bufflehead, Hooded Merganser, Barred Owl • dens for larger mammals such as grey squirrel, raccoon, American marten
Extra Large	• round or irregular hole larger than 15 cm wide • size of volleyball or larger • usually created by decay rather than woodpeckers • tend to be roost sites and escape cavities rather than nests

Logs and Down Woody Debris

(alias downed woody debris, coarse woody debris, fallen trees, dead wood, rotten logs, nurse logs)

Log Ecology and Wildlife

A tree naturally falling to the ground is not a loss to the forest. The log and the disturbance it creates are more like a boom town.

Like a backhoe, the roots of a wind-thrown tree tear up the ground, exposing fresh soil in pockets throughout the forest (see the **Mounds and Pits** section). Young trees, shrubs and wildflowers thrive on the disturbed soil and the new-found light on the forest floor. Animals such as winter wrens, water-thrushes, mice and chipmunks use the tangled root mass as housing. If these tip-up mounds are near open areas, they may be used by groundhogs. Wrenched roots in forests often form the framework for black bear dens.

Snapped-off tree trunks lack the ripped-up root wad but they take on a dual personality — as both a log on the ground and as a hard snag. Trees may be held up by nearby trees and branches for some time. These trees dry out and decay more slowly as a result.

Once they hit the ground, insects move in. Bark beetles, armed with mandibles that can penetrate the tough outer bark, chew into the protein-rich sapwood. Carpenter ants, which do not eat wood, carve tunnels for their colonies. These insect pioneers pave the way for the next wave of immigrants — fungi, bacteria, and other microscopic animals. Populations of nematodes, also known as roundworms, explode in rotting logs. Nematodes provide a food supply for mites and insects while higher up the food chain await predators such as woodpeckers and salamanders.

A spectacular array of mushrooms, slime moulds and shelf fungi live on logs. Their intricate structures are just a hint of the mass of tiny threads, called hyphae, that permeate the wood. Mosses and lichens also grow attached to woody debris. Many forest mosses grow only on bark or dead wood.

Old growth forests retain soil moisture because of the continual build up of logs and woody debris on the forest floor. A well-decomposed log acts as a water reservoir and nurturing oasis to some animals during dry spells and a stable environment for rooting of many plants.

Soggy logs provide moisture, protection from predators and a source of invertebrate food for salamanders. Eastern redback salamanders, which breath through their skin, are log specialists. Instead of using standing water, they lay their eggs in moist rotting wood. Ringneck snakes and smooth green snakes also lay their eggs within logs.

Ruffed grouse use dead logs and stumps as a stage to establish territories and attract a mate. Males broadcast their drumming sound by beating air between their wings. Large logs give the bird height to better project sound and scan for preda-

Rotten logs are moist environments for wildlife such as salamanders.

tors. Goshawks — who also happen to prey on grouse — often use logs and stumps as plucking perches. Mice, voles, marten and other mammals use the wooden straightaways of logs and large branches as travel paths.

Dead wood in water is also important. Logs and root masses along shore provide cover for small fish and in lakes are protective backdrops for many smallmouth bass nests. Ancient logs are preserved in waters all around you, especially cold lakes. Researchers have found water-logged hemlock trees that have lasted over a thousand years after falling into the lake, and are looking at their growth rings to study climate and forest history.

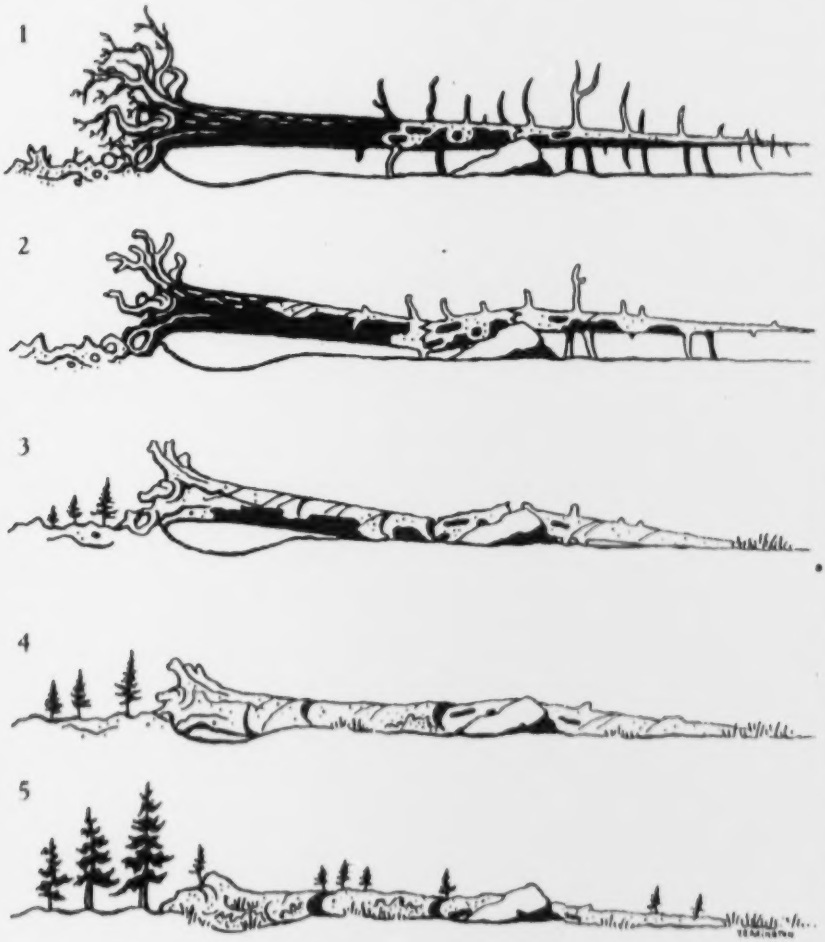
Streams in old growth forests often have tumbling cascades that form when water flows over logs, branches and woody debris. The scaled-down waterfalls, rapids and pools create micro-habitats for a diversity of aquatic life. The pools can be refuges for juvenile brook trout of lakes downstream. Ancient or old growth forests are known for their diverse, scenic streams with large amounts of woody debris.

As logs get recycled back to the soil, they pass through several stages of decay. Pine logs decay very slowly and may take 100 to 200 years to break down, while poplar and maple decay more quickly. The logs are important to wildlife habitat and the forest at each stage — so it is valuable to learn to identify some of the log variations.

The **Guide to Logs** on the following pages will help you identify some stages in the life of a log, and study the variety of log life.

A Guide to Logs

Look at the different logs around the forest. Look at the different sizes and states of decay. As with snags, logs do not always conform to neat categories. Birch logs, for example, may be rotten mush on the inside, while the bark remains intact. The important point is that the log provides food and shelter for wildlife and substrate for plants as it decays.



LOG ETIQUETTE

Looking beneath logs is a good way to start studying the ecology of downed woody debris. But be careful. If you roll a log over to look beneath it, remember to roll it back. If the log is left rolled over, the moist micro-habitat will dry out and will take quite a while to recover.

Decay Class	Form and Shape of Log	Branches	Bark	Wood Moisture and Texture	Plant and Animal Habitat
Decay Class 1	• Tree recently fallen, form still distinct • Log round and rigid	• May be elevated by branch stubs or ground	• Bark intact	• Solid, rigid tree with dry, hard wood	• Little or no new plant growth on log • Site for grouse drumming and woodpecker foraging
Decay Class 2	• Form still distinct • Log round • Log supports weight of a person	• Branches and branch stubs mostly gone	• Bark loose but patches may still remain	• Moist wood, beginning to soften • Log somewhat rigid but sags	• Some new moss, lichen, fungal and algal growth on parts of the log • Grouse drumming and woodpecker foraging site
Decay Class 3	• Log round but sags to conform with ground contours	• No branches	• Trace of bark	• Wood breaks into large hard pieces • Log does not fully support weight of person	• Tree seedlings and flowering plants begin to grow on log • Bear foraging site (ants)
Decay Class 4	• Log round to oval • All of log on ground • Becoming meshed with soil	• No branches	• No bark	• Wood breaks into small, soft and/or moist pieces	• Log soft • Nurse log for tree seedlings • Breeding site for snakes and salamanders
Decay Class 5	• Log rotten and covered with litter • Log oval or flattened • All of log on ground or beneath surface of ground or leaf litter	• No branches	• No bark	• Soft and powdery wood • May not appear as log at first glance	• Nurse log for tree seedlings • Perched trees or seedlings may be only evidence of log • Breeding site for snakes and salamanders

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Mounds and Pits

(alias microtopography)

If you vapourized all the live and dead vegetation from a forest, you would reveal a landscape of craters and mounds. Bedrock and rubble make some of these humps and hollows. But much of this "microtopography," especially in old growth forests, is made by the trees themselves.

Explore recent windfalls. The roots may yank up earth, rock and plant material and create small craters. You can often see this material still stuck in the tangle of roots.

Wind and snowstorms commonly topple trees in every forest. Violent storms and tornadoes can break or uproot entire stands. Wind gusts hitting snow-laden branches may knock down groups of trees. Individual trees with weakened roots or large wind-catching crowns may fall on their own.

Canopy gaps left by uprooted trees are important to forests because they allow sunlight to reach the forest floor. The mounds and pits created over the life of a forest (maybe hundreds or thousands of years) are also important — they add soil diversity and new sites for regeneration. Up to one half of the forest floor could be covered with young and old mounds and pits from uprooted trees. People studying soil find that the backhoe action of the wrenched roots creates complex soil profiles with inverted earth layers.

Look for small craters or hummocks in your forest. They can be as wide as a bed or a small room and up to a metre deep, depending on the size of the tree that fell over. Bowl-shaped pits are likely caused by deep-rooted trees such as pine and hemlock. The presence of some large bowl-shaped pits in a young forest can be evidence of large pine, hemlock or hardwood forests of the past. Shallow pits created by the shallow-rooting species such as spruce, fir and beech are soon obliterated by vegetation growth and soil settling. Larger craters can last a long time.

Trees rarely grow in the bottom of these pits. Leaf litter collects there and may be too deep for small seedlings to penetrate. The edges of mounds and pits, on the other hand, are good rooting sites and trees often get established there, taking advantage of the light-filled gap created by the fallen tree. These pits are rich microhabitats and support higher diversities of insects than the surrounding forest floor.

Second growth forests that grew up on abandoned farmland may not have much mound and pit microtopography. The till and plow would have flattened and mixed up the soil before the land was abandoned. Managed forests may also have lost their natural microtopography through the action of heavy machinery used to prepare cutover areas for planting and tree regeneration. Old growth forests have highly diverse microtopography that creates diverse habitats for plants and invertebrates.

The uprooting of a tree is a natural event that adds diversity to forest habitat.

Dead Wood I.D.

Identifying the species of a dead tree, log or stump can be a challenge. A tree guide will help you identify the species, or at least help determine whether it is coniferous or deciduous. Bark, branch and wood characteristics are good clues.

Look for pieces of bark on the wood or on the ground nearby. Species with decay-resistant bark such as white birch or eastern white cedar can be relatively easy to identify. Leaves, needles or seeds may also be found on the forest floor near recently fallen trees. Conifers like pines and hemlocks set out branches in rings around the trunk. Evidence of these branches may still be on the dead tree or downed log.

If you are interested in fungi, your field guide may help you. For example, the shiny purplish varnish shelf fungus grows only on conifers and mainly on hemlock wood. The well-known artist's conk fungus grows mostly on dead hardwood trees.

If you are really curious and have no other clues, you can determine if the dead tree is coniferous of deciduous by looking at a thin slice of the wood under a dissecting microscope. The wood must not be too rotten to do this. Coniferous wood is made up mostly of similar-sized cells (called tracheids) and looks something like a honeycomb. Deciduous trees such as maples, poplar, birches, beeches and cherries have wood with a mixture of different-sized cells (called vessels, fibres and parenchyma) with more of a swiss cheese appearance. The wood of oaks, ashes, elms and hickories has very large pores concentrated in a band that can be visible to the naked eye.

The weight of the wood might also be a clue. Most deciduous trees have harder, heavier wood than most coniferous trees. There are variations of course — poplar, a deciduous tree, has light wood, while hemlock, a conifer, has heavier wood.

Fallen Tree History

The collapse of a tree triggers a number of events that you can trace by examining the "scene of the crash." Your detective work may turn up the following:

• **Injured bystanders.** Falling trees may leave scars on nearby living trees as souvenirs of the event. The wounds often heal over but can become entry points for decay. This is good for cavity creation but could spell the demise of the injured tree down the road. Look for damaged bark, shaved branches or deformed wood to see which trees were hit.

Falling trees leave casualties in their path.

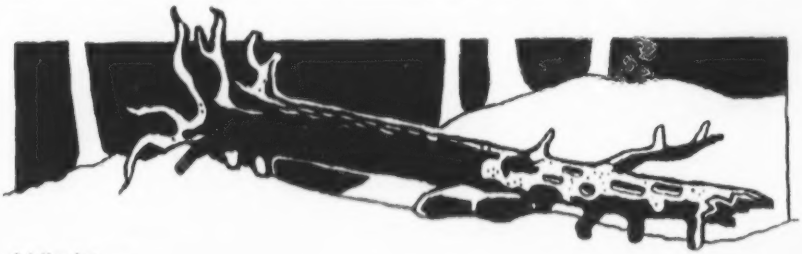
• **Domino effect.** When large trees fall they may uproot or snap trees in their path. Years after the event you can often tell where a fallen tree had killed some of its neighbours. Look for broken or dead trees in a swath around downed logs. The direction of fallen logs may tell you the direction of the prevailing winds as well.

• **Bringing the house down.** When single trees or small groups of trees fall over, they produce scattered openings throughout the forest that are important for regeneration. Size is crucial. Gaps created by single trees are most common. Small gaps in the canopy may be filled by the branches of nearby trees. Small gaps also allow tree seedlings that do not require large amounts of light, such as maple and beech, to flourish.

In old growth forests, large trees can take out several other trees when they fall, creating larger gaps.

Look around any gap to see which tree or trees take advantage of the opening — are they young saplings or are mature neighbouring trees filling the space with their branches?

• **Euthanasia or natural death?** Was the tree living or dead when it fell? If the downed tree has withered leaves and fine branches it was probably alive or only recently dead when it keeled over. A living tree with intact branches creates more damage to nearby trees than dead trees, and therefore leave more evidence of their fall.



A fallen log .....

Squashed green branches or disturbance to fresh vegetation are clues that the tree fell recently. Recently fallen logs may already be in a high stage of decay if the tree was dead when it fell. Look at any fungi growing on the log. Wood rotting fungi such as shelf fungi that are now sideways had emerged from the trunk before the tree fell — another clue that the tree could have been dead when it fell.

Nurse Logs and Perched Trees

Any gardener knows that fibrous material is a good soil conditioner. This also works in forests. Rotting logs eventually form a woody mulch valuable to soil life. Even before this stage, tree seedlings may already get a toehold in the log.

Yellow birch, eastern hemlock, balsam fir, white birch and some other trees take advantage of "nurse logs." Their lightweight seeds have a hard time penetrating thick leaf litter. Old logs, stumps and root mounds are free of deep litter and may protrude above the snow — both assets for some seeds to germinate and start growing.

Logs are a rooting medium but are not a source of all the necessary nutrients. Seedlings, therefore, send small rootlets through the decaying wood to reach the soil. By the time the nurse

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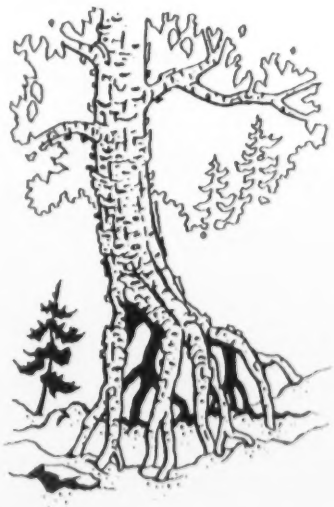
.....the fourth life of a tree.

Tree seedlings often colonize rotten logs.



Yellow birch trees often start life on a log and remain "perched" when the old wood decays.

logs (or stumps or tip-up mounds) decay and subside, the roots may be strong enough to hold the tree perched off the ground. Ground fires naturally help species such as hemlock and yellow birch by burning away leaf litter. But because fires are suppressed today, rooting on logs may be much more crucial to them than it was in the past. Look for evidence of the former log or stump under any perched trees you find.

You can estimate the size of the nurse log (or stump) by looking at the height a tree is perched above the ground. As the stumps decay the trees are often left suspended at the height of germination. You can estimate when a log or stump became rotten enough to become a nurse log by the age of perched trees or saplings growing on top. If perched trees started their lives on stumps, the age of the live tree tells you the stump was created at least that long ago. The age of the perched tree also tells you how long it is taking for the nurse log to decay. A poplar, for example, will rot away quickly while a hemlock remains in place for much longer.

Looking at Tree Rings

(alias dendrochronology)

"Dendrochronology" is a ten-dollar word for studying tree rings. Foresters

rely on accurate tree ages to help plan forest management. But trees can divulge much more than just their age in tree rings. Scientists are turning more and more to tree ring studies as a source of information on climate change and forest history. The technique is not beyond the amateur naturalist.

An increment borer is the best means of getting accurate tree ages. If you are able to examine a tree core, or to look at recent stumps, you can look at growth rates and how they changed over the years. Take some sandpaper to the surface to get a better look at the structure of the wood.

A spurt of large ring widths means the tree had some good growing seasons. This can indicate the early years of a stand of trees or a time when the tree was given more light and soil resources when a neighbouring tree died. Look at adjacent trees for gaps, fallen trees or other signs to relate to the growth rates of the trees.

Fire Scars and Charred Stumps

Trees, logs or stumps may have blackened wounds from fires. The tree may have been killed by a severe fire. Or a light ground fire may have charred the bark or created a small wound. Scars of several fires can be found on trees such as oak and pine which can withstand lighter fires. Tree cores often have fire scars.

Counting those scars can give an idea of how often fire burned through the area. Researchers are using fire scars (in tree cores and stumps) to compare the frequency of fires in the past with more recent times. With far fewer fires in the forest today, the mix and abundance of tree species and other plants is likely to change.

Charcoal or blackened wood may even be found in the soil by digging down below the litter layer.

Fires of the past leave clues such as the charred remains of old stumps.

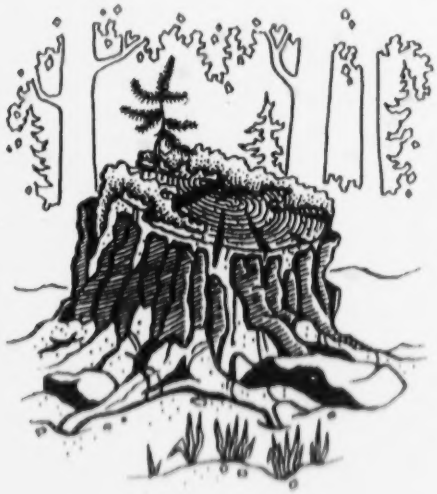
The Stump Forest

Searching for stumps is a way to inspect for past logging activity and to study its potential impact on the forest of today. Using the forest signs and field tips in this handbook along the way opens up a window to forest ecology.

Old growth forests have not had much logging compared to other forests. Habitat conditions are different, partly because nature has determined the future of the forest more so than chainsaws or axes. In early logging days, lumbermen selected huge specimens of white pine in the central and northern parts of the province and oak in the south for ship masts. Some of their stumps are still evident today.

By looking for stumps you may be able to determine what was removed from the stand and compare it with what is there now. Some trees sprout from their own cut stumps and continue to live using the existing root system.

Hemlock trees were eliminated from many forests around the turn of the century for the tanning industry. In some places you can find more stumps than living hemlock trees or hemlock regeneration. Yellow birch was important for building planes in the Second World War, and was selectively removed from many forests. Stumps of American elm and American chestnut (in the south) also remain in many woods, reminders of their former status in forests before disease nearly wiped them out.



Look for wounds at the base of trees. These could be signs of logging damage of the past. These wounds can injure and even kill some trees.

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PAPER TRAILS

Former forests have left their mark on the land and the **Forest Signs and Field Tips** in this manual give you an idea how and where to look for them. However, you can also turn to written records to better understand the early forests and forest history.

Local Histories

Local history books were often written to document the first European settlers' arrival in some areas. In Ontario this often followed the era of heavy logging and widespread fires of the 1800s. There is great forest information in these histories.

Cut trees were often called "sticks" in those days. You can read about 60 foot long pine logs that were 36 inches square and of 118 foot masts that took 14 teams of horses to haul out. You can still find some large old trees that bear the marks and stamps that identified them as Crown property destined for the British Royal Navy. To qualify as a potential mast for the Royal Navy, a red or white pine had to be perfectly straight, with the first branches (knots) appearing not less than sixty feet above the ground.

Notes and photos of the logging days are full of stories of giant trees coming out of local forests. Knowing the former forests helps you imagine what woodlands can become if they are left uncut.

Old photos show you where massive fires rampaged in the 1800s. Many of these fires were caused by people and made worse by large amounts of slash and woody debris left over from logging activity. Those fires created conditions that greatly affected the forests on the land today.

The settlers' own experience with forest clearing can also tell you much. There are stories of a single pine tree being used to build an entire house. Often the first income settlers made from their land was from burning the huge tree stumps to create potash for fertilizing crop lands. Photos of early dwellings surrounded by stumps can be revealing — some buildings still remain, in various states of repair, surrounded by farmland or new forests. Finally, local histories can also give you hints of where logging did not occur.

Early explorers often wrote journals that provide information on the stature of the forests — forests of gigantic trees, stands that the sun never penetrated, tracts with large numbers of windblown trees, tangles of downed logs and great trees that were rotten from top to bottom. The explorers often provided their perspectives in these notes as well — dark, mossy, ponderous places, the solitude of deep forests, the cathedral-like silence of some stands. Their notes make interesting reading.

Survey Records

Land often had to be surveyed before it was assigned to settlers or allocated

to loggers. Some of the first written accounts of many tracts of land in North America were the original notes of the surveyors. These pioneers were the first to lay out the lines and grids of the lots and concessions familiar to us today. Their job was to parcel up the land and to document its natural conditions for severance, settling, logging or farming. Forest information, drainage, rock types and even wildlife and other features were noted. Surveyors also documented great disturbances such as fires and windstorms.

In Ontario most original Crown surveyors working in the 1800s systematically noted tree species along their survey lines. They generally listed the tree species in order of abundance, although there could have been a bias towards trees like pine which were much sought after. They sometimes identified, marked and measured "witness" trees. Witness trees were reference points for corner posts and stakes. Some corner posts and blazes on witness trees are still visible today.

You can try to roughly "reconstruct" the forest of the past using survey records and other detective work. Since distances were indicated between the entries of the surveyor's notes, you can roughly summarize how much of the line he traversed was covered by which tree species. This can give you a rough idea of how much of each forest was around over a broad area at the time of the survey over a broad area. Alternatively, you may wish to find out what was growing at a specific location.

This is interesting information for landowners or people responsible for natural areas. Original surveys give you a baseline to compare with present or future forests. Some people work with original records to plan restoration planting, using them to decide what type of forest to aim for when planting abandoned farmland back to trees. The records do not tell you what ought to be there now because, after all, more than a hundred years have passed. But they do offer a snapshot in time that will help people understand the land and perhaps make decisions on future forest management. Some areas of Crown land still remain unsurveyed, a testimony more to the poor quality of the land for logging and settlement than to any oversight.

Walking lot and concession lines with notes in hand makes for an interesting tour. The forests you see can be quite similar or quite different from those of a century ago, depending on what has happened to the property since. Oak forests on rocky ridges, for example, may once have been pine forests that were cut and burnt (often repeatedly). Look for charred pine stumps in these stands.

The mix of species in hardwood stands and lowland forests may have changed little, with some notable exceptions. The widespread loss of American elm (white elm) is an example. The elm was decimated in many areas by the onslaught of the Dutch elm disease around a century ago. When you look at the old survey records and examine the dead trees still

in the forest, you come to appreciate just how common the stately elm once was. In places like southern Ontario you may also find many notations of another lost species — the once abundant American chestnut.

Ontario residents can obtain copies of the original survey notes of most properties. Local Offices of the Ontario Ministry of Natural Resources (MNR) often have copies. MNR technicians still refer to the records when laying out timber harvesting plans or when resolving boundary disputes between Crown and private properties. You must identify the appropriate lot and concession lines for the property and there may be a small fee. Contact the Information Officer at the Ontario Ministry of Natural Resources, Survey Records Office, Queen's Park, Toronto, Ontario M7A 1W3.

Resource Reports

(Logging and Fire History Reports, Cutover Maps, Forest Resource Inventory Information)

If you are interested in the resource management history and old growth potential of Ontario Crown forests, you can find some information at local Ministry of Natural Resources (MNR) offices. **Cutover maps** are usually compiled to trace the history of cutting and silviculture work on Crown forests. You might give the forestry staff a call to inquire before you head into the office. Have the lot and concession and other basic information available. You can trace cutting for decades with this technique, learning what has happened on the property in question. Besides this paper trail, local staff and long-time residents are a wealth of information that they might wish to provide.

Fire history maps have also been compiled to show where burns have taken place over the last several decades. Long-term fire history takes more digging. Contact staff in the fire management section of your local MNR office for more information.

Forest resource inventory maps have been compiled for decades. Comparing maps of your area from each inventory period allows you to see if the forest has changed as a result of logging or other disturbance.

Ground fires may burn off leaves and woody debris but only singe the bark of big old trees.

REFERENCES AND FURTHER READING

Technical Reports and Documents

Ontario Ministry of Natural Resources

Old Growth Policy Advisory Committee. 1994. *Conserving Ontario's Old Growth Forest Ecosystems.* Final Report and Highlights and Recommendations of Old Growth Forests Policy Advisory Committee, Toronto, Ontario.

(Single copies of publications available at no charge from Ministry of Natural Resources, Natural Resources Information Centre, M1-73, Macdonald Block, 900 Bay Street, Toronto, Ontario M7A 2C1.)

Anderson, H. W. and J.A. Rice. 1993. *A Tree Marking Guide for the Tolerant Hardwoods Working Group in Ontario.* Ontario Ministry of Natural Resources, Toronto. 227 pp.

(Single copies available for $27.50 from Ministry of Natural Resources, Natural Resources Information Centre, M1-73, Macdonald Block, 900 Bay Street, Toronto, Ontario M7A 2C1.)

White, D. J. 1990. *Preliminary Definitions and Evaluation of Old-Growth Forest in Eastern Ontario.* Contract report to Ontario Ministry of Natural Resources, Kemptville, Ontario. 60 pp.

Ontario Forest Research Institute (OFRI)

Ontario Forest Research Institute Research Report Series. Several recent titles reviewed for this handbook include studies of dendrochronology, fire history, forest disturbance and old growth.

Forest Fragmentation and Biodiversity Project. Several important background documents and field studies of old growth forests have been produced by the Forest Landscape Ecology Program.

(Single copies of any of these reports available at no charge from Ministry of Natural Resources, Ontario Forest Research Institute P.O. Box 969, 1235 Queen Street East, Sault Ste. Marie, Ontario P6A 5N5.)

Eastern Ontario Model Forest (EOMF) Group

Keddy, C. 1994. *Forest History of Eastern Ontario.* EOMF Information Report No. 1, Brockville Ontario. 41 pp, plus appendices.

Keddy, C. 1994. *Forest Structure of Eastern North America.* EOMF Information Report No. 9, Brockville, Ontario. 39 pp., plus appendices.

Keddy, P. and C. Drummond. 1994. *Ecological Properties for the Evaluation of Eastern Ontario Forest Ecosystems.* EOMF Report.

(Single copies of these publications are available at no charge from the Eastern Ontario Model Forest, P.O. Bag 2111, Kemptville, Ontario K0G 1J0.)

Canadian Nature Federation

Canadian Nature Federation. 1996. *An Ancient Forest Atlas of the Lake Temagami Site Region* (4E).

(Copies of the atlas are available from the Canadian Nature Federation.)

Ancient Forest Explorations and Research (AFER)

Forest Landscape Baselines. Progress and summary reports on old growth and ancient forests in Ontario.

Background Reading

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Kimmins, J.P. 1992. *Balancing Act: Environmental Issues in Forestry*. University of British Columbia Press, Vancouver. 244 pp.

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Tubbs, C. H., DeGraaf, R. M., Yamasaki, M. and W. M. Healy. 1987. *Guide to Wildlife Tree Management in New England Northern Hardwoods*. USDA Forest Service Northeastern Forest Experiment Station General Technical Report NE-118.

Information for Families, Landowners, Educators and Travellers

Canadian Nature Federation

Exploring Old Growth Forests — A Teacher's Manual. 1996.

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Home Sweet Hole. Family Supplement. 1989.

Old Growth Forests. Family Supplement. 1990.

(Copies available for $1.00 each from Federation of Ontario Naturalists, 355 Lesmill Road, Don Mills, Ontario M3B 2W8.)

Council of Outdoor Educators of Ontario (COEO)

Quest for Cavities: A Hole-istic Simulation Game. Published in *Pathways* (COEO newsletter): Vol 2, No. 6, October 1990.

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Quinby, P. 1993. *Ancient Forest Exploration Guide. A Field Guide to Selected Old-Growth Red and White Pine Forests in Ontario*. Published by Ancient Forests Exploration and Research, Powassan, Ontario. 36 pp.

(Copies are available for $4.95 from AFER at 39 Westmoreland Avenue, Toronto, Ontario M6H 2Z8.)

Ontario Ministry of Natural Resources

Cavity Trees are Refuges for Wildlife. 1995.

Restoring Old-Growth Features to Managed Forests in Southern Ontario. 1996.

(Copies of these Extension Notes are available at no charge from the Eastern Ontario Model Forest, P.O. Bag 2111, Kemptville Ontario K0G 1J0.)

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OLD FOREST CHECKLIST

This list is a summary of features and habitat you can expect to find in old growth forests. To some degree you can also find them as important ingredients of other forests.
You can keep track of the size or quantity of the features listed here, or simply check those off that you see. The idea is to appreciate the diversity that exists in old growth forests. Enjoy the search!

OLD TREES, BIG TREES

Dominant species	Ages	Diameter	Height

OLD FOREST WILDLIFE AND HABITAT

Species seen that use dead trees, cavity trees, logs or old forests	

SUPERCANOPY TREES

Present	Absent	Species and Wildlife use

NURSE LOGS AND PERCHED TREES

Present	Absent	Tree species

FIRE SCARS

Present	Absent	Tree species affected

STUMPS

Present	Absent	Tree species and sizes

DEAD STANDING TREES (SNAGS)

Decay class	1	2	3	4	5
Small (Up to 10 cm dbh)					
Medium (10 cm to 50 cm dbh)					
Large (more than 50 cm dbh)					
Dead tree species (list)					

TREE CAVITIES

Cavity type	In what trees? (for example, pine maple etc.)				
	Pine	Maple			
Small					
Medium					
Large					
Extra-large					
Escape cavities and roost trees					

LOGS AND DOWN WOODY DEBRIS

Decay class	1	2	3	4	5
Small (up to 50 cm wide)					
Large (more than 50 cm wide)					

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About the Author

Mark Stabb is a writer and biologist living in Arnprior, Ontario. Mark has a deep personal interest in forest conservation and environmental education. He has authored many popular articles, government publications and technical reports on ecology and nature conservation. He received the Ontario Forestry Association's White Pine Award for his education efforts.

Mark has a keen interest in what he calls "forest geriatrics" — the old, dying and dead parts of the forest — and the contribution these "old growth ingredients" make to forest habitat. He has given close to 100 presentations on cavity-nesting wildlife and biodiversity conservation to a wide variety of audiences. Mark spends much of his spare time exploring forests and natural areas and hiking with his family.

About the Artist

Originally from North Bay, Ontario, Tim Yearington is a professional freelance illustrator now living in the Ottawa Valley. He is truly fascinated by the majestic and primeval character of old growth forests and is committed to its protection. He still spends much of his free time exploring the ancient pine forests of the Temagami area.

Much of Tim's personal artwork is inspired by the dynamic elements within old growth that he encounters during his own forest treks. His acrylic paintings and sketches vividly depict the essence of "Ontario Old-Growth" which has evolved into a consistent theme for his wilderness art.

Tim's personal love of forests and wilderness has become woven into his career as a visual communicator. His work as an "environmental illustrator" — helping to promote the protection of healthy environments and endangered ecosystems — has been used by Environment Canada, the Canadian Parks and Wilderness Society, the Ontario Parks Association, *Field and Stream* magazine and now the Canadian Nature Federation. He may be contacted at: Box 811, R.R. #3, Woodlawn, Ontario K0A 3M0. Phone and fax (613) 832-0879.